The College Board Review

NEWS AND RESEARCH OF THE COLLEGE ENTRANCE EXAMINATION BOARD

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THE 1948 ANNUAL HANDBOOK

The 1948 edition of the Annual Handbook is scheduled for publication on November 1, 1947. Information concerning terms of admission, expenses, and scholarship aid is given for each college. The new edition is being distributed much earlier in the academic year than the previous edition; it is hoped that the earlier publication date will make the Handbook more generally useful to school principals and guid-

(*Continued on page* 18)

COMPARISON OF PROBLEM TYPES IN THE COMPREHENSIVE MATHEMATICS TEST

Multiple-Choice Type Found Valid

By Lynnette B. Plumlee*

Test Construction Department

Within the past two years two important changes have been made in the Comprehensive Mathematics Test. The first change was from an examination containing both traditional "demonstrative"-type problems and "answer-only" problems to an examination containing the latter type exclusively. The second change was to an examination composed entirely of "multiple-choice" problems. (Examples of these different problem types are given in the following section.) The changes were made only after considerable investigation and deliberation. Factors which were taken into account include:

(a) Test reliability (agreement between alternate forms of a test).

(b) Test validity (agreement between test scores and achievement in college-mathematics courses).

(c) Accuracy, speed, and economy of scoring.

(*Continued on page* 29)

* For advice and general counsel in applying the results of this study to the Comprehensive Mathematics Test, acknowledgement is made to Professor S. S. Wilks, Consultant of the College Entrance Examination Board, and Professor J. R. Kline, Chief Examiner in Mathematics.

THE COLLEGE BOARD REVIEW

News and Research of the
College Entrance Examination Board

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Editor.....HERBERT S. CONRAD
Associate Editor,
EDITH M. HUDDLESTON
Assistant Editor.....JOHN W. FRENCH
Circulation Manager,
CATHERINE G. SHARP

The 1948 Annual Handbook

(*Continued from page* 17)

ance officers and to students who wish to gain admission to college in the fall of 1948.

Other changes in the new edition include new prefatory articles which describe the Board's series of entrance examinations, set forth the philosophy that underlies the Board's testing programs, and list (with brief descriptions) those national and regional scholarship programs which involve use of the Board's tests but which are not restricted to a single college or university. A greater degree of uniformity in the individual college statements has been achieved in this edition. Also, somewhat more specific information is provided concerning the entrance tests required by each college, average expenses at the college, and scholarships and loan funds. A new type of index groups the colleges geographically, and gives for each college the total undergraduate enrollment for 1946-1947.

President-Emerita Ada Comstock Notestein of Radcliffe College has again served as General Editor and as Chairman of the Handbook Committee.

Copies of the HANDBOOK will be distributed without charge to the colleges and schools most closely concerned with the Board's activities. Orders for additional copies, at a price of $1.50, should be sent to the College Entrance Examination Board, 425 West 117th Street, New York, N.Y.

KAIDEN-KAZANJIAN

PROFESSOR EDWARD S. NOYES
Chairman of the College Entrance Examination Board, 1945-

Edward S. Noyes, Associate Professor of English and Chairman of the Board of Admissions at Yale University, was elected Chairman of the College Entrance Examination Board in October, 1945. For more than twenty-five years he had been closely associated with the work of the College Board, as Reader, Chief Reader, and from 1939 to 1945 also as Chief Examiner in English. During this period, in collaboration with Professor J. M. Stalnaker and Professor W. M. Sale, he published studies of the comprehensive examination and of the new one-hour composition test, both of which he helped to develop. Before 1945 he served on the Committee on Examination Subjects and Requirements, on the Executive Committee, and as Vice-Chairman of the Board.

During Professor Noyes' tenure as Chairman, an important internal reorganization of the Board has been effected. Professor Noyes was a member of the committee which drew up the new ARTICLES OF ASSOCIATION AND BY-LAWS.

NUMBER OF CANDIDATES REACHES NEW PEAK

By Ledyard R Tucker
Department of Statistical Analysis

The activity of the College Entrance Examination Board has been at a record level during the present fiscal year. Sixty-five thousand candidates were examined in the regular college-entrance series; over 200,000 test papers were scored. Both the number of candidates tested and the number of tests administered to these candidates increased about 40 per cent over the figures for 1946 —itself a record year.

Figure 1 shows the trend in number of candidates tested in the regular series during the last five years. The year 1943 is representative of the preceding five years. An increase in the number of candidates began in the war-years of 1943-1945, and has continued at an accelerated pace during the last two years. The result of this trend is that the number of candidates tested is now *double* the number tested two years ago, and almost *triple* the pre-war level.

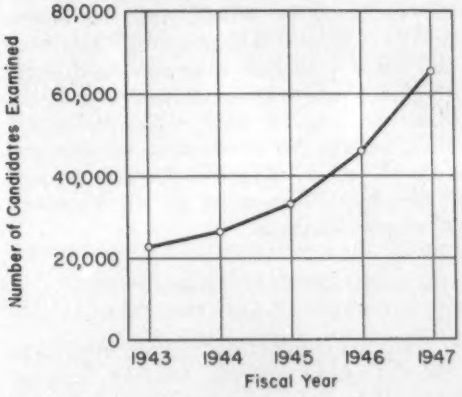

Fig. 1.

Five-Year Trend in Number of Candidates Examined at Regular Series

The Board's work has also been characterized by striking seasonal variation. Figure 2 shows the number of tests administered, scored, and reported for each of the regular series during the last two fiscal years.* Candidates at each series take from one to five tests, with an average of 3.3 tests per candidate. This year the 58,000 candidates who attended the morning session took two tests each: a verbal section, and a mathematical section of either the Scholastic Aptitude Test or the Comprehensive Mathematics Test. The 34,000 candidates who attended the afternoon sessions took one, two, or three tests each. A separate score was obtained and reported for each of the 200,000 test papers. About two-thirds of the work was in connection with the April examinations.

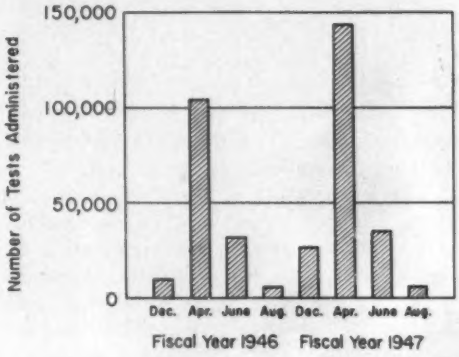

Fig. 2.

Seasonal Variation in Tests Administered at Regular Series during the Last Two Fiscal Years

Besides examining candidates in the regular college-entrance series, the Board has examined during this year 40,000 candidates for the Naval College Training Programs, 40,000 for Pepsi-Cola scholarships, 10,000 veterans at special centers, and 10,000 candidates for other programs (including entrance examinations for the United States Naval and Military Academies).

* The fiscal year of the College Board extends from October 1 to September 30 of the following year, and is named by the year in which it ends. Each fiscal year includes the December series in the preceding calendar year.

VALIDITY OF THE SPECIAL APTITUDE TEST FOR VETERANS

By Norman Frederiksen
Research Department

A study has just been completed in which the validity of the Special Aptitude Test for Veterans was investigated. Data for this study were obtained from several colleges of the University of Pennsylvania. The special veterans' test was found to be almost as good a predictor of college grades as the regular tests of the College Board.

THE VETERANS' TEST

The Special Aptitude Test for Veterans was prepared specifically for men and women who were returning from war service. It was designed as a test which would emphasize aptitude rather than achievement, in order that servicemen who have been out of school for several years might not be unduly penalized. The first form of the test was designated *SV*, and the test has come to be known commonly as the *SV* test.

The test consists of three one-hour sections. The first section is verbal in content; scores on this section are comparable to verbal scores on the Scholastic Aptitude Test. Section Two is mathematical, and stresses mathematical manipulation and ingenuity rather than mastery of advanced subject matter. For Section Three the candidate may choose Spatial Relations, Science, or Social Studies. The science section stresses common-sense informational material, and the social studies section requires the student to read with comprehension material from the social science field. The spatial relations section, testing ability to visualize spatially, was not investigated in this study.

The special veterans' test was administered at various member-colleges by regular college personnel. In addition, testing centers were established in nine cities scattered across the country, where the test was given every two weeks. In this way it was possible for veterans to be tested at various times and places. Veterans who wished to be examined for college entrance soon after their discharge were thus not limited by the four-times-a-year schedule of the regular Board series.

SOURCE OF THE DATA

One of the first large-scale users of the Special Aptitude Test for Veterans was the University of Pennsylvania. Arrangements were made, through the cooperation of Sherman Oberly, Dean of Admissions, and Miles Murphy, Personnel Officer in the College of Arts and Sciences, to obtain the necessary information for a study of the test. Data were obtained for veteran students in the College of Arts and Sciences, the Wharton School of Finance and Commerce, the Towne Scientific School, and the Moore School of Electrical Engineering. Data from the last two schools were combined, since the first-term freshman courses were essentially the same for many of the students in these schools. No information was obtained from the other colleges at the University of Pennsylvania because of the small number of veteran students.

PREDICTION OF GRADES IN THE COLLEGE OF ARTS AND SCIENCES

The data obtained for veteran students in the College of Arts and Sciences included Verbal, Mathematical, and Social Studies scores on the Special Aptitude Test for Veterans, the high school quintile, number of years since high school graduation, and, as criteria, grades in all courses taken during the first term of the freshman year. From the course grades an unweighted average was computed, although at Pennsylvania

average grades are not routinely calculated. The only course taken by a large proportion of the veteran freshmen was English 1.

The correlations of the predictive measures with English 1 grades and with first-term average are shown in Table 1. The best predictor of success in college, as measured by first-term freshman average, is the verbal score (correlation of .49). The other two test scores have slightly lower validities, and high-school quintile has a validity correlation of .32. Number of years since high-school graduation has very little predictive value, even though there is considerable variability with respect to this factor.* Prediction of the first-term average grade can be improved somewhat by combining verbal and mathematical scores: the multiple correlation (not shown in the table) for this combination is .56.

TABLE 1

Correlations with Grades in the College of Arts and Sciences ($N = 83$)

Variable	Correlation with First-Term Average	Correlation with English 1
SV—Verbal	.49	.52
SV—Mathematical	.39	.31
SV—Social Studies	.42	.45
High-school quintile	.32	.10
Years since high-school graduation	.07	.13

PREDICTION OF WHARTON SCHOOL GRADES

All students in the Wharton School take the same set of required courses. Validity coefficients for this school are shown in Table 2. The table shows that the best predictor of success is, in general, the verbal score, although the mathematics score is best for predicting grades in Accounting 1. High-school quintile has limited predictive value, and years since graduation again has little relation to college grades.

* The standard deviation of the distribution of number of years since graduation was 2.7; the average number of years since graduation was 5.7.

TABLE 2

Correlations with Grades in the Wharton School ($N = 152$)

Variable	Correlation with—			
	Engl. 1	Acct'g 1	Geog. 1	Pol. Sci. 1
SV—Verbal	.43	.22	.35	.42
SV—Mathematical	.30	.37	.25	.13
SV—Social Studies	.34	.26	.32	.32
High-school quintile	.19	.27	.27	.30
Years since high-school graduation	—.06	.21	.12	.21

PREDICTION OF GRADES IN SCIENCE SCHOOLS

The criteria of success in the Moore School of Electrical Engineering and the Towne Scientific School were grades in several required courses: English 1, Mathematics N3, GE 101 (drawing), and Chemistry 1. The validity of the predictive measures for these schools is shown in Table 3. The *N*'s on which these correlations are based vary from 43 to 76.

TABLE 3

Correlations with Grades in the Two Science Schools ($N = 43$-76)

Variable	Correlation with—			
	Engl. 1	Math. N3	GE 101	Chem. 1
SV—Verbal	.52	.08	.23	.21
SV—Mathematical	.28	.57	.10	.46
SV—Science	.28	.04	.50	.19
High-school quintile	.25	.52	.03	.55
Years since high-school graduation	.42	.09	.17	—.14

Again the best predictor of English 1 grades is the verbal score (correlation of .52). Grades in Mathematics N3 are well predicted by the mathematical score (correlation of .57), while the drawing grade is best predicted by the science score (correlation of .50). The Chemistry grade, however, is more closely related to the high-school quintile (correlation of .55) than to any test score. For the veterans in the present study,

the number of years since graduation is most closely related to English 1 grade: those who have been out of school longest tend to make the best grades. The opposite tends slightly to be true for Chemistry grades.

ROLE OF YEARS SINCE HIGH-SCHOOL GRADUATION

The predominantly positive correlations between college grades and years since high-school graduation, shown in Tables 1, 2, and 3, indicate that veterans who have been away from high school longest are not handicapped; as a matter of fact, there is a tendency—very slight—for veterans who have been out of school longest to make the best grades in college. To explain this fact one might conjecture that a selective factor is operating, such that the veterans who have been out of school longest tend not to go to college unless they have made unusually good records in high school. The data in the first line of Table 4 bear on this hypothesis. Table 4 gives the correlations of years since graduation with high-school quintile and with veterans' test scores. The correlations with high-school quintile are too low to confirm the hypothesis that a selective factor is in operation.

TABLE 4

Correlations of Years Since High-School Graduation with High-School Quintile and Veterans' Test Scores

Variable	Correlations in the—		
	College of Arts and Sciences	Wharton School	Science Schools
High-school quintile	—.03	.02	.12
SV—Verbal	.18	.05	.37
SV—Mathematical	—.27	—.07	.10
SV—Social Studies	.02	—.09	——
SV—Science	——	——	.13

It is possible that, at other universities, a higher correlation might be found between high-school achievement and years since graduation, because admissions policies could easily influence this relationship. An admissions officer might, for example, refuse to admit the veterans who had been out of high school longest unless their high-school records were exceptionally good.

The positive correlations of years since graduation with the verbal score suggest that higher verbal facility tends to be associated with increasing experience or maturity. The predominantly negative correlations with the mathematical score suggest that mathematical ability scores tend to decline with lack of recent practice.

CONCLUSIONS

1. Although the samples are not large, the evidence indicates that the Special Aptitude Test for Veterans is valid for predicting scholastic success as measured by first-term course grades; however, the validity coefficients are in general somewhat lower than those usually obtained for the regular College Board tests.

2. High-school quintile was found, in general, to have less predictive value than the test scores. Measures of high-school success usually have greater predictive value than was found in this study. The predictive value of the high-school quintile may have been lowered somewhat by the fact that, on the average, five or six years have elapsed since the graduation of these students from high school. It is also likely that the predictive value of *rank* in class would be somewhat greater than that of quintile-position, because of the coarseness of the latter measure.

3. Number of years since high-school graduation was found to have little relationship to success in college; there was evidence that veterans who have been out of school longest are not handicapped with respect to ability to do college work. A slight tendency was found for better grades to be obtained by those out of school longest. One might suppose that this slight tendency arises from self-selection—i.e., that

students who have been out of high school for a long time tend not to come back to college unless they have been unusually successful in high school. This hypothesis of self-selection, however, is not borne out by the facts in the present case, because the correlations of years since graduation with high-school quintile are very low.

SCHEDULE FOR NAVAL COLLEGE TRAINING PROGRAM, 1947-1948

The Navy and Marine Corps are now starting their second annual selection of students for the Naval College Training Program. Winners in the competition will be enrolled in college NROTC units in the fall of 1948. Several thousand young men will be selected. The College Entrance Examination Board is again cooperating fully with the Navy Department in the preparation, administration, scoring, and reporting of the Navy College Aptitude Test, which all competitors are required to take as the first hurdle in the selection process. The whole schedule, in this second year, has been pushed back closer to the beginning of the academic year 1947-1948.

Candidates can obtain a bulletin of information and an application blank from schools and colleges in the States and Territories; these materials will be mailed from the Board during the third week of September 1947. The Board will also send these materials, on request, to individuals. A reminder letter will be sent to schools and colleges about October 10-15. *Enlisted men* in the Navy and Marine Corps should apply through their commanding officers to the BUREAU OF NAVAL PERSONNEL. *Civilian candidates from schools and colleges* must complete their application blanks and send them directly to the NAVAL EXAMINING SECTION, COLLEGE ENTRANCE EXAMINATION BOARD, P. O. Box 709, PRINCETON, N.J. *Applications received at that address later than November 10, 1947 cannot be accepted.*

The Navy College Aptitude Test will be administered on December 13, 1947, at centers in every State and Territory. Each properly registered candidate will receive his ticket of admission before that date. The record sheets of the finalist candidates, who have qualified by test score for further consideration, will be mailed about January 20, 1948 to the Offices of Naval Officer Procurement. These Offices will write directly to the finalists, who will then undergo physical examinations and interviews. Announcements to unsuccessful candidates will be mailed about January 25.

The Naval College Training Program remains the only nation-wide program of scholarship aid for college education that is financed completely by the federal government. The general plan for the program is substantially unchanged, and the benefits to the successful candidates remain the same. NROTC students will attend one of the 52 colleges having naval reserve units. Tuition, books, fees, and necessary uniforms will be provided by the Navy, and each student will receive a living allowance of $600 for each of the four years of attendance at college. Each student will then become a commissioned officer and will spend two years on active duty with the Navy or Marine Corps.

By a recent decision of the Navy Department, no new students will be admitted to the Naval Aviation College Program in the fall of 1948; therefore no selection of new students for this program will be undertaken. About 400 winners from the first annual competition will be entering college under the NACP program in the fall of 1947.

VALIDITY OF THE GERMAN PLACEMENT TEST

Relation between Test Scores and College Grades

By Henry S. Dyer

Harvard University

College teachers of elementary foreign language have found from experience that the number of years an incoming freshman has studied a language in secondary school, and the quality of his work as evidenced by school grades, do not provide an adequate basis for deciding at what point the student should begin his study of the language in college. This situation is no reflection upon the instruction given by the preparatory schools. It is simply the result of a democratic system in which the schools are left free to determine their own language curricula and standards of grading. Nevertheless, if college freshmen are to be placed in the language courses they are best equipped to handle, some common measure of current level of performance is indispensable; and this measure must have a close and ascertainable relation to college standards. The C.E.E.B. foreign-language placement tests were devised to meet this need. The purpose of this paper is to present statistical evidence, obtained at Harvard, regarding the validity of the German Placement Test of the College Entrance Examination Board.

One should clearly distinguish between the concept of a measure of current level of performance and the concept of a prediction of future performance. In the case of the C.E.E.B. German Placement Test, all we ask is that it tell us where the student is in the subject at the time he is to begin his college work. We do not ask the test to predict the quality of the student's work. If we can "place" him properly at the start, we assume that we have removed all the handicaps that might prevent him from giving the best possible account of himself.

THE DATA

An indication of the degree to which the C.E.E.B. German test measures "current level of performance" can be obtained by giving the test at a time when level of performance is known from some other source, which we call the criterion measure, and comparing the test scores with the criterion scores. In the present study the criterion scores were the final grades obtained in five types of elementary German courses, as follows:

German I, a first-semester course.
German II, a second-semester course.
German I-II, an intensive course which completes the work of the first two semesters in one semester.
German III, a third-semester course.
German III-IV, an intensive course which completes the work of the third and fourth semesters in one semester.

Data were available from nine different classes: two classes in German I, one in German II, three in German I-II, one in German III, and two in German III-IV. The different courses were given variously in the spring, summer, and fall terms of 1945.

The C.E.E.B. tests were administered approximately two weeks before the final examination in each course, but the results were not used in the computation of the final grades. It is believed that under these conditions the correlations obtained between test scores and final grades provide a reasonably good index of the degree to which the test measures level of performance in the reading of German.

RESULTS

Table 1 gives, for each course, the correlation between scores on the C.E.E.B. German Placement Test and final grades.

TABLE 1

Correlations between C.E.E.B. German Placement Test Scores and Final Grades

Course	No. of Students	Correlation	r^2
German I (a)	114	.64	.41
German I (b)	43	.43	.18
German II	23	.78	.61
German I-II (a)	42	.75	.56
German I-II (b)	41	.76	.58
German I-II (c)	21	.77	.59
German III	52	.78	.61
German III-IV (a)	36	.87	.76
German III-IV (b)	27	.78	.61

It is evident from Table 1 that the correlation of test scores with final grades tends to be appreciably lower for the first-semester group than for the more advanced groups. This result is scarcely surprising. The C.E.E.B. German Test is aimed primarily at students who have completed at least two years of secondary-school work in German. In order to provide an optimum sampling of the reading ability of these and more advanced students, it seems reasonable to suppose that some sacrifice has had to be made in the number of questions placed on a difficulty-level suitable for students just beginning their study of German.

One way of comprehending the "goodness" of a correlation is to consider its square. The square of the correlation coefficient in the present instance expresses the degree to which individual differences in final grades can be estimated from knowledge of the test scores alone. The squares of the correlation coefficients are shown in Table 1 in the column labeled "r^2." For all but the first-semester courses, the individual differences in final grades can be estimated to an extent greater than fifty per cent; or, to put it another way, the C.E.E.B. German Placement Test provides in a single hour of testing time a measure of performance which includes more than half of the factors which determine the final course-grades of students beyond the first-semester level. In the opinion of the writer, the results for the higher courses indicate a satisfactory degree of comparability between test scores and grades.

FACTORS NOT MEASURED BY THE TEST

Factors which influence course grades but which are *not* measured by the test may well be accounted for by the following considerations:

1. The German test purports to be solely a test of ability to read German; whereas the final grades represent, at least to some extent, a number of additional skills, such as those involved in German composition, which are not specifically sampled by the test.

2. In certain individual cases there may have been an increase in the level of performance during the two weeks that elapsed between the C.E.E.B. test and the final examination, since some students are prone to use just those two weeks to "cram for finals."

3. Certain of the final grades may have been affected by penalties inflicted during the semester for tardiness in the completion of assigned work. Such penalties often decrease the final grade in such a way that it does not reflect the student's true level of performance at the end of the term.

The writer suggests that the unmeasured factors just described are not particularly relevant in determining the level of a student's German reading performance; and that if it were possible to eliminate their effect on final grades, all but a negligible portion of individual differences in grades would be estimable from the test scores—except in the case of students at the first-semester level.

VALIDITIES OF SEPARATE PARTS OF THE TEST

Under ordinary conditions, the separate sections of the German Test are not individually timed; one hour is given for the entire test, and the student is left to his own devices to decide how he should apportion his time among the four sections. Since, within the hour allotted, a good many students do not finish the test and some may not reach Part IV at all, it was considered of some importance to determine under more rigorously controlled conditions the relative value of each part of the test.

To investigate this matter, the test was given in certain courses with separate timing of the individual parts, thereby insuring that each student had a chance to sample each part. The courses involved were German I (a), German I (b), German I-II (c), and German III. The correlations obtained between part scores and final grades give some idea of the relative validity of the different parts for students of varying levels of competence. Table 2 gives the essential data.

TABLE 2

Correlations between Part-Scores on the C.E.E.B. German Test and Final Grades in Various Courses

Course	TEST SECTION				
	Part I	Part II	Part III	Part IV	Total Test
German I (a) ($N = 114$)	.29	.48	.54	.44	.64
German I (b) ($N = 43$)	.15	.35	.36	.22	.43
Ger. I-II (c) ($N = 21$)	.71	.50	.69	.72	.77
German III ($N = 52$)	.64	.76	.57	.62	.78

Although the limitations of the data forbid any general conclusions, they nevertheless suggest that there is considerable difference in the validity of the several parts for students of varying levels of competence. Part I worked least well for first-semester students, second best for second- and third-semester students. Part IV worked best for second-semester students, third best for first- and third-semester students. A comparison of the four "total test" correlations with those of the remaining five courses given in Table 1 seems to indicate that the timing of the individual parts has little if any effect on the over-all validity of the test.

SUMMARY

When the C.E.E.B. German Placement Test was given approximately two weeks before final examinations to students in elementary German courses at Harvard it was found that:

1. The test scores provided a measure of reading performance sufficiently accurate to warrant their use for the placement of incoming freshmen.

2. The test is a somewhat less accurate measure of reading performance when used with first-semester students than it is when used with more advanced students.

3. There is probably considerable difference in the validity of the several parts of the test, some parts being more valid for students in less advanced classes, others more valid for students in later classes.

4. Timing of the separate parts of the test does not appear to improve its over-all validity as a measure of reading performance.

A BINDER FOR THE "REVIEW"

Many persons will find it convenient to file their copies of THE COLLEGE BOARD REVIEW in a loose-leaf binder. A well-constructed, attractive binder, designed especially for the REVIEW, is obtainable from the College Entrance Examination Board (P.O. Box 592, Princeton, N.J.) at cost, for $2.00. This binder is 10 inches high and 9¼ inches wide; it will fit into nearly all book shelves. The "backbone" of the binder bears the title, THE COLLEGE BOARD REVIEW.

In Brief . . .

January test series added. In the academic year 1947-48 the College Board examinations will be given five times: in December, January, April, June and August. (For list of dates, see back cover.) There are several advantages connected with a late January series. In the first place, it comes after the end of the first term, and so is a more natural testing time than December. In the second place, many colleges prefer to have their candidates examined earlier than April, especially when only the Scholastic Aptitude Test is required for admission. In the third place, the January test meets the desires of students who must take their achievement tests in April, but prefer to take the SAT at a different time; because of the short interval between January and the April series, SAT scores made at either of these series should be closely comparable.

Whether both the December and January dates will be retained in 1948-49, or whether one or the other of them will be dropped or shifted, will be decided at the October 1947 meeting of the Board.

Intermediate Mathematics Test added to morning program. At its meeting in April 1947 the Board voted to add to each series, beginning with the series of December 1947, an achievement test in mathematics for students with three years' preparation in that subject. The new test, to be called the Intermediate Mathematics Test, will presuppose less training than does the Comprehensive Mathematics Test, which will continue to cover four years of secondary-school mathematics. The Intermediate Mathematics Test will, however, call for more advanced mathematical training than the mathematics section of the Scholastic Aptitude Test, which stresses reasoning problems based on arithmetic and the rudiments of algebra and geometry. The three levels of mathematics tests will be given as alternatives in the morning session, following the verbal section of the Scholastic Aptitude Test.

Descriptions of the three morning programs and sample questions from all of the tests are contained in the BULLETIN OF INFORMATION for 1947-48, obtainable from the College Entrance Examination Board on request.

Greek and Italian tests will be offered. In April 1948, new one-hour achievement tests in Greek and Italian will be added to the present College Board battery. These additions will bring the number of afternoon achievement tests in the April series to a total of twelve, of which six will be foreign-language tests. Because of the relatively small number of candidates expected to register for Greek or Italian, it is probable that these two tests will be offered only at the specific examination centers where candidates have indicated in advance that they wish to take them. The decision to add Greek and Italian was made by the Board at its meeting in October 1946, upon recommendations by the Committee on Examinations and the Executive Committee. No commitment was made to offer the tests at other times of the year or at the April series after 1948.

English Examination for Foreign Students will be given in November 1947. The first regular edition of the English Examination for Foreign Students will be administered at overseas centers during the week of November 9-16, 1947, and again during the week of February 29-March 7, 1948. The purpose of the examination, as described in the full-page article on page 7 of the last issue of the REVIEW, is to aid in determining whether foreign applicants for admission to colleges in the United States have sufficient knowledge of English to enable them to undertake college work in this country.

Regular examination centers will be distributed all over the world, except in the United States. The exact date of the test at any particular center will be set, within

the time limits indicated above, by the local examination supervisor. In those centers where the local supervisors are willing, the examination may also be administered as often as once a month throughout the year, provided the number of candidates is sufficiently large. The examination fee at overseas centers will be three dollars in the Western Hemisphere and ten dollars in the Eastern Hemisphere (United States currency).

In addition to the regular overseas administrations, the examination will be made available to any institution for administration to its own applicants at any time or place designated by that institution. In this way, foreign students who are already in this country may have an opportunity to take the test. Institutions using this service will be required to pay to the Board a fee of two dollars per candidate.

Further information regarding the details of administration may be had upon request from the College Entrance Examination Board. It is expected that this examination will become a permanent feature of the Board's program.

West Coast office established. Plans have been completed for the establishment of a West Coast branch office of the Board. On October 1, 1947, the new office will be in operation as an information center and as a means of closer contact between the Board and the growing number of candidates and member colleges in the West. Dr. A. Glenwood Walker has been appointed director of the new office, which is located at 2207 Shattuck Ave., Berkeley 4, California. *For the present, West Coast applications and fees should still be sent to P.O. Box 592, Princeton, N.J.*

Pepsi-Cola finalists to take Scholastic Aptitude Test. On January 24, 1948, more than 800 candidates for Pepsi-Cola scholarships and certificates of merit will report at Board centers to take the Scholastic Aptitude Test. These candidates will be the top-scoring students among nearly 50,000 seniors in secondary schools throughout the United States, Alaska, Hawaii, and Puerto Rico taking the Pepsi-Cola Scholarship Test on November 21, 1947. The use of a second examination marks a departure from the practice of previous years, when only the Pepsi-Cola Scholarship Test was employed.

Further discussion of proposed merger of non-profit testing agencies. It was reported in the Spring 1947 issue of THE COLLEGE BOARD REVIEW that the Board had appointed a committee to study the possibility of a merger of educational testing agencies, as proposed by the Committee on Testing of the Carnegie Foundation. The special committee appointed by the Board issued a report which agreed with that of the Carnegie Committee in advocating an integration of non-profit testing groups (specifically, the testing agencies of the College Board, the American Council on Education, and the Carnegie Foundation), but which differed from the Carnegie Committee's recommendations in regard to the structure, financing, and autonomy of the proposed new organization. The proposal provides for the continuation of the College Entrance Examination Board as a separate educational association, but advocates that a central testing agency be established to handle the examinations of the Board and of other organizations concerned with educational measurement. After discussion of the plan the Board at its April 1947 meeting voted unanimously to adopt the report of its special committee in principle, as a basis for negotiation with the other agencies concerned. The merger plan is at present under active consideration by the parties to the proposed new organization, and will be the subject of further discussion at the October 1947 meeting of the Board. Future developments concerning this important proposal will be reported in succeeding issues of the REVIEW.

Fourteen new member institutions. The College Entrance Examination Board extends a most sincere welcome to the fourteen colleges and universities admitted to

membership in April. The new members are Boston University, Chestnut Hill College, Coe College, Muhlenberg College, Newcomb College of Tulane University, Oberlin College, Pomona College, Randolph-Macon Woman's College, Rosemont College, University of Notre Dame, Ursinus College, Washington and Jefferson College, Whitman College, and Wilson College. We are proud to add these names to the College Board roster, which now lists sixty-nine member institutions.

Comparison of Problem Types in the Comprehensive Mathematics Test

(*Continued from page* 17)

(d) Subject-matter coverage (adequacy with which the test covers the desired material).

EXAMPLES OF PROBLEM TYPES

Following are examples of the problem types mentioned above:

(1) "Demonstrative" type–

Two guns are fired at the same instant and an observer hears the report of the guns 3 seconds and 5 seconds later. The angle at the observer's eye subtended by the distance between the guns is 38° 43′. How many feet apart are the guns? (Assume that sound travels 1100 feet per second.)*

This type of problem is designed to measure performance of a connected series of operations. The amount of credit received by the candidate for each problem depends upon the reader's judgment of the completeness and accuracy of the candidate's solution.

(2) "Answer-only" type–

A car travels from N to P at an average rate of r miles per hour and returns from P to N at an average rate of t miles per hour. What is the car's average rate for the whole trip?

———m.p.h.†

In this type of problem, the candidate is given full credit if his final answer is correct, and no credit if it is wrong.

* The correct answer is 3580 ft. (using 4-place tables).

† The correct answer is $\frac{2rt}{r+t}$.

(3) "Multiple-choice" type–

In this type of problem answer-options are given. The incorrect answer-options are based on the most popular wrong methods of solution adopted by students. As an example of the "multiple-choice" type, the foregoing "answer-only" problem is presented below with answer-options.

A car travels from N to P at an average rate of r miles per hour and returns from P to N at an average rate of t miles per hour. What is the car's average rate (in miles per hour) for the whole trip?*

(A) $\frac{r+t}{2rt}$ (B) $\frac{2}{r+t}$ (C) $\frac{r+t}{2}$

(D) $r+t$ (E) $\frac{2rt}{r+t}$

A summary of the evidence, which led finally to the adoption of the multiple-choice type of problem, is presented in the following paragraphs.

A COMPARISON OF MULTIPLE-CHOICE AND ANSWER-ONLY TYPES

In a special study made in 1942, 80 mathematics problems were prepared both in multiple-choice form and in answer-only form. The first 40 questions were administered to Group A (283 college students) in multiple-choice form and to Group B (282 college students) in answer-only form. The last 40 questions were administered to Group A in answer-only form and to Group B in multiple-choice form. Coefficients of

* The correct answer is option (E). The most popular wrong method of solution, a simple average, leads to option (C).

reliability and validity for each answer-type were calculated, separately for each group, as shown in Table 1. The comparison, for each group, of the coefficients for multiple-choice with the corresponding coefficients for answer-only, shows quite clearly that the two problem types were practically equally reliable, and that they predicted rank-standing in the first-year mathematics course equally well.

TABLE 1

Comparison of Multiple-Choice and Answer-Only Types

	Multiple-Choice Form	Answer-Only Form
Reliability Coefficient:*		
Group *A*	.74	.79
Group *B*	.76	.75
Validity Coefficient:†		
Group *A*	.64	.60
Group *B*	.57	.58

"ANSWER-ONLY" FORM SUPERIOR TO "DEMONSTRATIVE" FORM

In a study of the April 1944 Comprehensive Mathematics Test, the reliability of the section of answer-only problems was found to be considerably higher than that of the section of demonstrative problems, for comparable testing time. The reliability coefficient of the answer-only section (computed for 553 candidates) was .92; that of the demonstrative section (computed for 552 candidates) was .75. It would be expected, therefore, that the reliability of the total test would have been increased if the section of demonstrative problems had been replaced by a second section of answer-only problems.

In a study made several years ago at two universities, a set of answer-only problems and an equally timed set of demonstrative problems were compared as to their value for predicting success in college mathematics courses. Average correlations between course-grade and scores on each section of the test, for nine mathematics classes at University *X*, and three mathematics classes at University *Y*, are shown in Table 2, below. The number of students per class ranged from 17 to 135 at University *X* and from 28 to 158 at University *Y*, with an average of 65. The comparisons in Table 2 indicate that, for a given testing time, the answer-only section yields higher correlations with grades in college mathematics than does the demonstrative section.

TABLE 2

Predictive Validity of Answer-Only and Demonstrative Sections of the Comprehensive Mathematics Test

University	Average Correlation	
	Answer-Only Section	Demonstrative Section
University *X* (9 classes)	.44	.37
University *Y* (3 classes)	.44	.38

SCORING

Of the three answer-forms discussed in this article, the multiple-choice can, of course, be most quickly and accurately scored. In scoring a demonstrative problem, the candidate's solution is given credit according to the completeness and accuracy of his method. However, the variety of methods used by different candidates in solving a demonstrative problem makes it impossible to compare accurately the quality of various solutions. The judgment as to equivalence of work by various methods is necessarily largely subjective.

Problems involved in scoring also constitute a major disadvantage of the answer-only type. Methods of solution which are essentially correct may not be given credit because of minor computational or transcription errors. Furthermore, a candidate who carries his work beyond the minimum stage required for credit receives no extra credit to compensate for the time he loses, and he has additional opportunity for making computational errors. It is impossible to establish rigidly consistent scoring pro-

* The reliability coefficient of each answer-type is the correlation between the odd- and even-numbered problems, corrected by the Spearman-Brown formula.

† The validity coefficient is the correlation between scores on each answer-form and rank-standing in a first-year college mathematics course.

cedures for the answer-only test which do not work injustices in some cases.

The multiple-choice form, on the other hand, definitely establishes the stage of solution that must be reached by all candidates. Minor computational errors may be corrected by the candidate. Wrong methods are likely to lead to one of the wrong answer-options. The burden of decision—which constitutes part of the test—is placed upon the candidate, rather than upon the scorer.

A practical factor requiring some consideration is the fact that accurate clerical workers may be used to score a multiple-choice test; whereas the scoring of an answer-only test requires persons with sufficient knowledge of mathematics to determine whether or not the recorded answer is equivalent to the answer on the key. The scoring of demonstrative problems requires still more highly qualified persons, who understand the subject-matter sufficiently to assay the nature and seriousness of the candidate's errors.

The approximate time required for scoring and checking a ninety-minute test in each of the three answer-forms is indicated in Table 3. Scoring and checking obviously take much longer for the demonstrative type of examination than for the multiple-choice.

TABLE 3

Approximate Time Required for Scoring Different Types of Mathematics Problems

Answer Form	Number of Problems per Paper	Time Required for Scoring and Checking 100 Papers
Multiple-Choice	50	2 hours
Answer-Only	50	12 hours
Demonstrative	8	45 hours

SUBJECT-MATTER COVERAGE

The foregoing evidence appears sufficient reason for preferring the multiple-choice to the answer-only or demonstrative forms for the Comprehensive Mathematics Test. The exclusive use of multiple-choice problems does not, however, mean that certain subject matter may now be omitted from the secondary school teaching of mathematics. Most problems which can be put into answer-only form can also be used in multiple-choice form; actually, some problems are more adaptable to the multiple-choice than to the answer-only form. Furthermore, the essential steps of the demonstrative problem can be tested in separate short problems of the multiple-choice variety. Separate short problems force the candidate to give evidence of his competence in each specific type of mathematical work. For example, a rapid computer can frequently avoid logarithms entirely in solving a demonstrative problem; but he *must* know how to use logarithms, in order to answer correctly a short problem aimed at testing this specific knowledge. In addition, a wider range of abilities can be measured by numerous short problems than by a much smaller number of long problems.

SUMMARY

In consideration of the facts summarized below, the Comprehensive Mathematics Test has been changed to multiple-choice form:

1. The multiple-choice test is equally reliable and equally useful for predictive purposes as an answer-only test administered with the same time limit. (Consult Table 1.)
2. A test composed of short problems, whether in multiple-choice or in answer-only form, is more reliable and more valid than a demonstrative test administered with the same time limit. (Consult page 30 and Tables 1-2.)
3. Multiple-choice problems can be more easily and more accurately scored than either of the other two answer-forms. (Consult Table 3.)
4. Subject matter may be covered about equally well in multiple-choice and answer-only tests, and more adequately in these tests than in the demonstrative test. (Consult page 31.)

It should be noted that the studies described in this article aimed to determine the best type of mathematics test for purposes of prediction. No implication is intended regarding the suitability of multiple-choice tests for diagnosing individual students' specific difficulties in mathematics.

DATES OF COLLEGE-ENTRANCE EXAMINATIONS

The College Entrance Examination Board has set the following schedule for its series of entrance examinations:

Saturday, December 6, 1947
Saturday, January 24, 1948
Saturday, April 3, 1948
Saturday, June 5, 1948
Wednesday, August 18, 1948

The complete series of examinations will be given on each examination date, except that the Greek and Italian examinations are scheduled only for April 3, 1948.

Applicants are urgently advised to obtain and complete their application forms *early*. The normal closing dates for the receipt of applications *in Princeton, N.J.* are as follows: for candidates east of the Mississippi River or on either bank of the Mississippi, *three weeks* before the date of the examination; for candidates west of the Mississippi River or in Canada, Mexico, or the West Indies, *four weeks* before the date of the examination; and for candidates outside of the United States, Canada, Mexico, and the West Indies, *seven weeks* before the date of the examination. Applications will continue to be accepted until a week before the examination date, but a penalty fee of three dollars (which should accompany the application) will be charged for applications received later than the normal closing date. *No applications received in Princeton later than one week before the examination date will be considered.*

The Board's BULLETIN OF INFORMATION, obtainable on request, gives detailed information concerning the examination-schedule, applications, fees, examination centers, and the general nature of the examinations.

DATE OF THE NROTC APTITUDE TEST

Civilian students from schools or colleges who wish to enroll in college NROTC units in the fall of 1948 must take the Navy College Aptitude Test. The date set for this examination is:

Saturday, December 13, 1947

Applications must be received in Princeton, N.J., no later than November 10, 1947.

For further particulars see the article on page 23 in this issue of THE COLLEGE BOARD REVIEW.